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Ion and electron radiolysis of Europa's surface

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We investigate the role of magnetospheric ion and electron bombardment on the radiolysis of Europa's surface. In this study we pay particular attention to the energetics of particle transport in the upper layer of ice ($<1\text{m}$). Data from both the Galileo Energetic Particles Detector (EPD) and the Voyager 2 Low Energy Charged Particle (LECP) detector are included. The Galileo measurements were made during the several near encounters with Europa. These data have been corrected for penetrating background and instrument saturation and degradation effects. The Voyager 2 electron data were taken during the inbound and outbound Jupiter passes, when the spacecraft was near Europa's orbit. Electron and ion energy spectra will be presented.

We also consider the radiation dose deposited by the incident charged particles in the upper layer of Europa's icy surface. These energy spectra are used as inputs to a simulation that calculates radiation dose versus depth. Results of this calculation for a pure water ice surface, including the contributions from bremsstrahlung, will be presented. The energy deposition rate into ice is found to be dominated at different depths alternately by electrons and ions. These data are presented as energy density deposited so they can be scaled and applied to other materials. In this presentation, the role these particles play in radiolytic processing of ice and non-ice regions and their role to determining the leading/trailing and other observational asymmetries will be discussed.